

(a) *Installation instructions.* (1) The location of engine mounting attachments, the method of attaching the engine to the aircraft, and the maximum allowable load for the mounting attachments and related structure.

(2) The location and description of engine connections to be attached to accessories, pipes, wires, cables, ducts, and cowlings.

(3) An outline drawing of the engine including overall dimensions.

(b) *Operation instructions.* (1) The operating limitations established by the Administrator.

(2) The power or thrust ratings and procedures for correcting for nonstandard atmosphere.

(3) The recommended procedures, under normal and extreme ambient conditions for—

- (i) Starting;
- (ii) Operating on the ground; and
- (iii) Operating during flight.

[Amdt. 33-6, 39 FR 35463, Oct. 1, 1974, as amended by Amdt. 33-9, 45 FR 60181, Sept. 11, 1980]

**§ 33.7 Engine ratings and operating limitations.**

(a) Engine ratings and operating limitations are established by the Administrator and included in the engine certificate data sheet specified in § 21.41 of this chapter, including ratings and limitations based on the operating conditions and information specified in this section, as applicable, and any other information found necessary for safe operation of the engine.

(b) For reciprocating engines, ratings and operating limitations are established relating to the following:

(1) Horsepower or torque, r.p.m., manifold pressure, and time at critical pressure altitude and sea level pressure altitude for—

(i) Rated maximum continuous power (relating to unsupercharged operation or to operation in each supercharger mode as applicable); and

(ii) Rated takeoff power (relating to unsupercharged operation or to operation in each supercharger mode as applicable).

(2) Fuel grade or specification.

(3) Oil grade or specification.

(4) Temperature of the—

(i) Cylinder;

(ii) Oil at the oil inlet; and

(iii) Turbosupercharger turbine wheel inlet gas.

(5) Pressure of—

(i) Fuel at the fuel inlet; and

(ii) Oil at the main oil gallery.

(6) Accessory drive torque and overhang moment.

(7) Component life.

(8) Turbosupercharger turbine wheel r.p.m.

(c) For turbine engines, ratings and operating limitations are established relating to the following:

(1) Horsepower, torque, or thrust, r.p.m., gas temperature, and time for—

(i) Rated maximum continuous power or thrust (augmented);

(ii) Rated maximum continuous power or thrust (unaugmented);

(iii) Rated takeoff power or thrust (augmented);

(iv) Rated takeoff power or thrust (unaugmented);

(v) Rated 30-minute OEI power;

(vi) Rated 2½-minute OEI power;

(vii) Rated continuous OEI power; and

(viii) Rated 2-minute OEI Power;

(ix) Rated 30-second OEI power; and

(x) Auxiliary power unit (APU) mode of operation.

(2) Fuel designation or specification.

(3) Oil grade or specification.

(4) Hydraulic fluid specification.

(5) Temperature of—

(i) Oil at a location specified by the applicant;

(ii) Induction air at the inlet face of a supersonic engine, including steady state operation and transient over-temperature and time allowed;

(iii) Hydraulic fluid of a supersonic engine;

(iv) Fuel at a location specified by the applicant; and

(v) External surfaces of the engine, if specified by the applicant.

(6) Pressure of—

(i) Fuel at the fuel inlet;

(ii) Oil at a location specified by the applicant;

(iii) Induction air at the inlet face of a supersonic engine, including steady state operation and transient over-pressure and time allowed; and

(iv) Hydraulic fluid.

(7) Accessory drive torque and overhang moment.

- (8) Component life.
- (9) Fuel filtration.
- (10) Oil filtration.
- (11) Bleed air.
- (12) The number of start-stop stress cycles approved for each rotor disc and spacer.
- (13) Inlet air distortion at the engine inlet.
- (14) Transient rotor shaft overspeed r.p.m., and number of overspeed occurrences.
- (15) Transient gas overtemperature, and number of overtemperature occurrences.
- (16) For engines to be used in supersonic aircraft, engine rotor windmilling rotational r.p.m.

[Amdt. 33-6, 39 FR 35463, Oct. 1, 1974, as amended by Amdt. 33-10, 49 FR 6850, Feb. 23, 1984; Amdt. 33-11, 51 FR 10346, Mar. 25, 1986; Amdt. 33-12, 53 FR 34220, Sept. 2, 1988; Amdt. 33-18, 61 FR 31328, June 19, 1996]

### § 33.8 Selection of engine power and thrust ratings.

- (a) Requested engine power and thrust ratings must be selected by the applicant.
- (b) Each selected rating must be for the lowest power or thrust that all engines of the same type may be expected to produce under the conditions used to determine that rating.

[Amdt. 33-3, 32 FR 3736, Mar. 4, 1967]

## Subpart B—Design and Construction; General

### § 33.11 Applicability.

This subpart prescribes the general design and construction requirements for reciprocating and turbine aircraft engines.

### § 33.13 [Reserved]

### § 33.14 Start-stop cyclic stress (low-cycle fatigue).

By a procedure approved by the FAA, operating limitations must be established which specify the maximum allowable number of start-stop stress cycles for each rotor structural part (such as discs, spacers, hubs, and shafts of the compressors and turbines), the failure of which could produce a hazard to the aircraft. A start-stop stress cycle consists of a flight cycle profile

or an equivalent representation of engine usage. It includes starting the engine, accelerating to maximum rated power or thrust, decelerating, and stopping. For each cycle, the rotor structural parts must reach stabilized temperature during engine operation at a maximum rate power or thrust and after engine shutdown, unless it is shown that the parts undergo the same stress range without temperature stabilization.

[Amdt. 33-10, 49 FR 6850, Feb. 23, 1984]

### § 33.15 Materials.

The suitability and durability of materials used in the engine must—

- (a) Be established on the basis of experience or tests; and
- (b) Conform to approved specifications (such as industry or military specifications) that ensure their having the strength and other properties assumed in the design data.

Secs. 313(a), 601, and 603, 72 Stat. 759, 775, 49 U.S.C. 1354(a), 1421, and 1423; sec. 6(c), 49 U.S.C. 1655(c)

[Amdt. 33-8, 42 FR 15047, Mar. 17, 1977, as amended by Amdt. 33-10, 49 FR 6850, Feb. 23, 1984]

### § 33.17 Fire prevention.

- (a) The design and construction of the engine and the materials used must minimize the probability of the occurrence and spread of fire. In addition, the design and construction of turbine engines must minimize the probability of the occurrence of an internal fire that could result in structural failure, overheating, or other hazardous conditions.

(b) Except as provided in paragraphs (c), (d), and (e) of this section, each external line, fitting, and other component, which contains or conveys flammable fluid must be fire resistant. Components must be shielded or located to safeguard against the ignition of leaking flammable fluid.

(c) Flammable fluid tanks and supports which are part of and attached to the engine must be fireproof or be enclosed by a fireproof shield unless damage by fire to any non-fireproof part will not cause leakage or spillage of flammable fluid. For a reciprocating engine having an integral oil sump of